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HEADQUARTERS JOINT TASE FORCE SEVEN APO 187 (HOW), c/o Postmester San Francisco, California

12 April 1954

MEMORANDOM FOR RECORD

BRAVO Shot, Operation CASTLE

- 1. PURPOSE: To make a matter of record operational aspects that were considered prior to ERAVO event of Operation CASTLE and to enalyze the resultant situation in light of available pre-shot and post-shot information.
- GENERAL INFORMATION: Operation CASTLE is pleaned to consist of a series of seven detonations at the Pacific Frowing Grounds, which encompasses Eniwetok and Bikini Atolls. BRAVO is the code name that was given the firing of the first device, SHRIPP, at 0645 M on 1 March 1954, off Namu Island, Bikini Atoll.

Subsequent to BRAVO detonation radioactive debris fell on certain inhabited atolls of the northern Marshall Islands. Radiation intensities rose to levels sufficient to warrant evacustion of four stolls and all personned were removed from these atolls to Ewajelein in accordance with the operational emergency plan of JTF SEVEN. Areas evacuated and gamma dosages received

ATOLL	POPULATION	DISTANCE FROM GROUND ZERO	DOSES RECEIVED
Ailinginee	17	79 NH	80 R (computed)
Rongelap	. 82	joo ww	100-130 R (computed)
Rongerik	28 #	153 NM	40 - 98 R (film badge)
Utirik	154	270 174	17 R (computed)

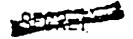
(#) 28 American Service personnel; 25 USAP Weather Detachment plus 3 USA Signal Corps personnel.

All evacuees are under competent medical care.

5. PREVIOUS EXPERIENCE AND CHARACTERISTICS OF NUCLEAR DETONATIONS: Redioactive debris is an incerent characteristic of all nuclear detonations. It originates from fission fragments

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which are the residue of bomb elements and surface materials, soil and water, made redicactive by accompanying radiation fields. Debris is sucked high into the atmosphere by efter winds of the explosion. Where this radioactive debris will fall is a major pre-shot consideration and primarily influences the decision to detonate a nuclear explosion at a certain time.

The area over which radioactive debris is spread and the intensity of fall-out on the ground are determined by the yield of the explosion as well as by wind pattern since the larger the yield, the more surface materials are sucked up into the cloud and the more fission fragments are available. The relationship between yield and fall-out is known only qualitatively.

- 4. PRE-SHOT INFORMATION: The operational aspects of the BRAVO experience were planned and conceived in the light of experience gained from previous operations. These factors were considered:
- a. The basis for forecasting where fallout will go is experience gained from overseas test operations CRCSSROADS, SANDSTONE, GREENHOUSE and IVY and to a certain extent from tests at the Neveda Proving Ground. Prior to the firing of BRAVO, only one megator yield device (IVY-MINE) had been deturated. Although conscientious efforts were made to dominant the fall-out from MINE, only about 5% of the total debris could ever be accounted for.

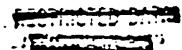
The technique used for forecasting fallout patterns is to consider the cloud as a smell area source (about a 15 mile radius); then add vectorially forecast winds from the surface to approximately 100,000 feet. The next step is to outline an area on the ground where fallout is expected. This area is computed by taking into consideration particle size, diffusion into the atmosphere, wind pattern, yield and source radius. Such patterns have been largely confirmed by experience in Nevada as well as by the meager data available here.

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- c. The surface reder was plotted, with an insurence factor edded, i.e., smaller particles then previous experience indicated necessary were considered. This doubled distances from ground zero where fallout was predicted to occur.
 - ous distances was considered to be of the same order of magnitude as for IVY-MIME. Radiation versus distance lines were transposed to Bikini Atoll.

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e. A critical problem in predicting fall-out in-.. forecasting the stability or lack of stability of the attern after shot time. Since radioactive particle tra-. determined primarily by the winds at each level, it is " wi that winds must be from favorable directions or very-.: hin the outer limits on favorable directions during the fallout. The critical fallout period was considered to the order of twelve to eighteen hours for significant .: to occur. The variation in time arises from consideraof wind shear, with more diffuse and less significant inies at a given time associated with lerge anguler and hear. For this reason, it was required that actual wind __out shot day be continuously considered in their relation is forecast conditions for the first twenty-four hours ile shot.

PRE-SHOT BRIFFINGS: The following were presented at -shot command briefings:

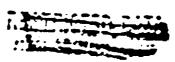
· a. Weather

Weather conditions during the five days prior to adicated a favorable trend for BRAVO day with easterly elow 15,000 feet and winds of a southerly component .. The situation presented at E-6 hours for the subsequent - period (18 hours after shot time) was satisfactory. The - - period to begin 18 hours after shot time was predicted an unfavorable trend as northwest winds were forecast → 10,000 to 20,000 foot levels.

RadSafe **b**.

- (1) Resultant wind diagrams including latest winds and forecast winds for H Hour and the 72 hour Rjectories, which gave a fellout pattern in a narrow 's the east northeast and a wide (1400) sector to the "h very slow resultant winds. (See Figure 1).
 - (2) Surface radex, H to H plus 6 hours. (See
 - (5) Outlooks for:
 - (a) Bikini: Unfavorable; Eniwetok: Favorable; Favorable, and the native populated atolls in southeast from ground zero favorable, since resultant winds in tion of theze areas were considered too slow to move at fallout to the atolls involved.
 - (b) Task Force fleet: Favorable, provided nd out at least 50 miles.

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- favorable. (e) Air routes through Wake and Ewajalein:
- dered in its relation to all known transient shipping: favor-

6. Scientific

- (1) High altitude sampling operations favor-
- (2) Light transmission for scientific experiments -

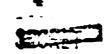
6. <u>COECIJSIOS</u>:

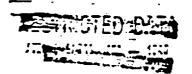
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. a. lack of fallout information from previous shots of comparable yield was a serious handicap.

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- e. The original source cannot be considered as a point or a relatively small area but must be considered to be an area of about a hundred miles in diameter. This diameter also depends on yield.
- d. The redirectivity of the debris can be considered proportional to yield. Redirective material in the cloud was thus two to three times was expected.
- e. An appreciable fraction of the observed fallout can only be accounted for by assuming that it originated in the stratosphere. For such particles to reach the ground at observed times, their diameter must have been in excess of 100 microns.
- essentially correct. Variation from forecast trajectories was approximately 10 degrees in significant upper levels; unfortunately, the variation was in the wrong direction (See Figure S). The small variations observed at lower levels were also in an unfavorable direction. Mevertheless, the accuracy of the winds aloft forecast approached the limits of accuracy of the wind observations themselves and were well within the normal forecast error.
- 5. The fallout pettern extended from the Bikini Atoll to the east northeast. Considerable widening of the pattern took place due to diffusion. The intensity of the





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pattern on the ground was due primarily to superposition of medicon eloud fallout on the stem cloud pattern; and the superposition can be attributed to the narrow cone within which the winds were acting. The theory that a significant fallout does not come from the stratosphere is not substantiated by the facts of HRAYO.

h. For future high yield shots, the forecast and cheered winds for the first twenty-four hour post-shot period should receive as much emphasis as analyses made for shot time.

FIGURIOS: Evacuation took place in accordance with operational emergency plan and without incident. Evacuation was not effected prior to detonation because no signifieast fallout was expected on inhabited areas.

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P. W. CLARKSON Kajor General, U.S. Army Commender

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5. Tab =B= - Heather
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6. Tab =C= - Medical (plus addendum)



